REMARKS

An Information Disclosure Statement is attached hereto.

In the Office Action dated June 26, 2006, claim 30 was rejected under 35 U.S.C. § 112, ¶ 1; claim 31 was rejected under § 112, ¶ 2; claims 1, 3-14, 17, 18, and 29 were rejected under § 103 over U.S. Patent No. 5,686,349 (Nakata '349) in view of U.S. Patent No. 6,271,062 (Nakata '062).

Applicant acknowledges the indication that claims 26, 27, 28, and 31 would be allowable if rewritten in independent form.

Claims 28 and 31 have been amended into independent form to place them in condition for allowance.

REJECTION UNDER 35 U.S.C. § 112, ¶ 1

Claim 30 has been amended to address the § 112, ¶ 1 rejection.

REJECTION UNDER 35 U.S.C. § 112, ¶ 2

Claim 31 has been amended to overcome the lack of antecedent basis rejection.

REJECTION UNDER 35 U.S.C. § 103

Claims 9 and 11 have been cancelled, without prejudice, to render the rejection of those claims moot.

It is respectfully submitted that claim 1 is not obvious over Nakata '349 in view of Nakata '062. The Office Action conceded that Nakata '349 does not teach depositing a microcrystalline thin film during the second process. 1/9/2006 Office Action at 7.

However, the Office Action maintained that after the stop of SiH_4 in Nakata '349, that the "process of Nakata '349 inherently results in at least a quantitative amount of continual deposition, during the second step, at which H_2 is maintained at a constant rate, due to the presence of SiH_4 and H_2 remaining in the process chamber." 6/26/2006 Office Action at 7-8. The Office Action asserted that "residual SiH_4 remaining in the process chamber with the constant flow of H_2 will result in a H_2 to SiH_4 dilution ratio to deposit a quantitative amount of microcrystalline thin film directly from the vapor phase, See Nakata '062 . . . ." *Id.* at 8.

The reference to residual SiH_4 remaining in the process chamber of Nakata '349 during the hydrogen plasma treatment phase of Nakata '349, and that this residual SiH_4 would deposit a microcrystalline thin film does not find any support in the teachings of Nakata '349. In fact, the teachings of Nakata '349 and Nakata '062 (the reference cited by the Office Action to combine with Nakata '349 in the obviousness rejection) establish that no residual SiH_4 would remain in the chamber 30. As shown in Fig. 1 of Nakata '349, an exhaust path 5 (not specifically described in Nakata '349) is depicted. Nakata '349 explains that valve 3 is open and valve 4 is closed (Fig. 1) to allow both a material gas and hydrogen gas to be introduced into the chamber 30. Nakata '349, 5:37-40. However, in the next phase, valve 4 is open and valve 3 is closed to allow only hydrogen gas (and not the material gas) to be introduced into the chamber 30. Nakata '349, 5:40-43. Importantly, when the valve 4 is open, the material gas is "directly exhausted by an exhausting pump (not shown)." Nakata '349, 5:40-42. Although stated as not shown in Nakata '349, Nakata '062 explicitly shows an exhausting pump 45 connected to the exhaust path (equivalent to exhaust path 5 in Nakata '349) of the chamber 51 of Nakata '062. In fact, valve 44 in Nakata '062 (which is the equivalent of valve 4 in Nakata '349) is shown in Fig. 2 of Nakata '062 as being coupled to the exhausting pump 45. *See* Nakata '062, 9:41-43 ("In contrast, when the valve 43 is closed and the valve 44 is opened, the material gas is exhausted directly by the exhausting pump 45 without being introduced into the reaction chamber 51."). In other words, as specifically taught by both Nakata '349 and Nakata '062, during the phase in which only hydrogen is delivered to the reaction chamber, the material gas through valve 4 is exhausted through an exhausting pump (45 in Nakata '062). Since the exhausting pump is coupled to the exhaust path 5 of Nakata '349, this necessarily means that any residual SiH_4 in the chamber would have been *exhausted* out of the chamber 30 by the exhausting pump when introduction of the material gas is stopped. *See* Wang Declaration Under 37 C.F.R. § 1.132, ¶ 6 (attached hereto). Due to the presence of the exhausting pump, a person of ordinary skill in the art would have understood that no deposition of a thin film would occur in the chamber during the plasma treatment stage of Nakata '349 when hydrogen only is being delivered. Wang Declaration, ¶ 7.

Moreover, what the Office Action has appeared to have ignored is that Nakata '349 specifically teaches a solution in Example 2 that would have taught a person of ordinary skill in

the art that depositing a microcrystalline thin film (rather than depositing an amorphous film) is possible *if both* SiH_4 and H_2 were *continuously* supplied (but with the flow rate of H_2 changed after an initial period). Nakata '349, 7:43-53. Example 2 of Nakata '349 indicates that the initial H_2/SiH_4 ratio is 200 or more, with the flow rate of H_2 subsequently reduced to achieve a dilution ratio of 2-100. As explained by both Nakata '349 and Nakata '062, the reduction of the dilution ratio of H_2 to SiH_4 is possible after the initial layer (about 100 angstroms) of microcrystalline thin film has been formed to continue depositing the microcrystalline thin film. *See* Nakata '349, 7:54-62; Nakata '062, 5:19-26; 11:37-44. In the Example 1 embodiment of Nakata '349, deposition of an *amorphous* silicon layer on the substrate occurs during the first time period in which the material gas (SiH_4) and hydrogen gas are introduced. Nakata '349, 5:45-58; 6:59-7:37. On the other hand, during the period in which only the hydrogen gas is introduced, the *amorphous* silicon layer that *has been deposited* on the substrate 10 is subjected to a hydrogen plasma treatment to convert the deposited amorphous silicon layer into a microcrystalline layer. Nakata '349, 5:58-61; 6:26-28; 7:18-20. (Note that the Example 1 technique described in Nakata '349 corresponds to the technique described in paragraphs [06]-[08] of the Background section of the present application that certain embodiments of the present invention seek to improve upon).

Thus, a person of ordinary skill in the art looking to the teachings of Nakata '349 and Nakata '062 would have been taught the following: to deposit a microcrystalline thin film in a *second* phase, microcrystalline thin film must first be deposited in a *first* phase by supplying *both* SiH_4 and H_2, followed by the second phase during which *both* SiH_4 and H_2 are also supplied (with the flow rate of H_2 reduced in the second phase) to continue depositing the microcrystalline thin film. Such a process is quite different from the subject matter of claim 1.

In fact, in the Example 1 embodiment of Nakata '349, if the Examiner were correct and there was residual SiH_4 remaining, then the remaining SiH_4 would be deposited onto the *amorphous* silicon layer as *amorphous* silicon, not microcrystalline silicon. *See* Wang Declaration, ¶ 8. In response to the above argument, the Office Action stated that Applicant's argument above that any remaining SiH_4 would be deposited as amorphous silicon is given little weight as "arguments of counsel unsupported by competent factual evidence." 6/26/2006 Office Action at 4. To address this assertion in the Office Action, Applicant has submitted the Wang

Declaration to establish that a person of ordinary skill in the art would understand that deposition of any residual SiH_4 in the chamber onto an amorphous silicon layer would result in continued deposition of amorphous silicon.

Therefore, it is respectfully submitted that claim 1 is non-obvious over Nakata '349 and Nakata '062.

Amended independent claim 29 is also non-obvious over Nakata '349 and Nakata '062, since claim 29 now recites that formation of a layer of an amorphous film is prevented during the source supplying process.

Dependent claims are allowable for at least the same reasons as corresponding independent claims.

In view of the foregoing, allowance of all claims is respectfully requested. The Commissioner is authorized to charge any additional fees and/or credit any overpayment to Deposit Account No. 20-1504 (CMO.0012US).

Respectfully submitted,

Date: Sept 26, 2006

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